

WHAT IS CLAIMED IS:

1. A pump delivery system comprising:

a pump mechanism for delivering a liquid under pressure and which generates a pulsating output during operation; and

a pump pulsation dampening assembly for substantially reducing said pulsating output of said pump mechanism, said pump pulsation dampening assembly including:

a pressurized vessel having an interior surface defining a chamber for receiving the liquid from said pump mechanism, said chamber also containing a pocket of pressurized air therein for absorbing said pulsating output generated by said pump mechanism;

a sensing mechanism for monitoring the air-to-liquid ratio inside the chamber, said sensing mechanism being adaptable for producing an output signal in response thereto; and

an adjustment mechanism in communication with said sensing mechanism and adapted to receive said output signal from said sensing mechanism and to provide an adjustment to the air-to-liquid ratio inside said chamber to a desired level in response thereto.

2. The pump delivery system of claim 1, wherein said adjustment mechanism automatically provides an adjustment to said air-to-liquid ratio.

3. The pump delivery system of claim 1, wherein said pump mechanism comprises a diaphragm pump.

4. The pump delivery system of claim 1, wherein said pump mechanism comprises a positive displacement pump.

5. The pump delivery system of claim 1, wherein said pump mechanism comprises a centrifugal pump.

6. The pump delivery system of claim 1, wherein said pump mechanism comprises a piston pump.

7. The pump delivery system of claim 1, wherein said sensing mechanism comprises a main body and a probe extending therefrom and into said chamber, said probe being adaptable to monitor the air-to-liquid ratio inside said chamber.

8. The pump delivery system of claim 1, wherein said pump pulsation dampening assembly further comprises a pressure regulator in communication with said chamber.

9. The pump delivery system of claim 1, further comprising a sanitary cleaning mechanism for cleaning-in-place the interior surface of said pressurized vessel.

10. The pump delivery system of claim 9, wherein said sanitary cleaning mechanism comprises a conduit having an inlet port for receiving a volume of sanitized fluid from a sanitized fluid source and an outlet port disposed inside said chamber for dispensing a sanitized fluid therein to facilitate cleaning-in-place of said interior surface of said pressurized vessel.

11. The pump delivery system of claim 10, wherein said outlet port comprises a nozzle head having a plurality of apertures for discharging the sanitized fluid.

12. The pump delivery system of claim 1, wherein said pump pulsation dampening assembly further comprises an over-pressure relief valve in communication with said pressurized vessel for discharging air

inside said chamber when the pressure inside said chamber exceeds a desired level.

13. A pump delivery system comprising a pump mechanism for delivering a liquid under pressure, said pump mechanism generating a pulsating output during operation, and a pump pulsation dampening assembly for dampening the pulsating output of said pump mechanism, said pump pulsation dampening assembly including a pressurized vessel having an interior surface defining a chamber for receiving the liquid, said chamber also containing a pocket of pressurized air therein for absorbing said pulsating output, said chamber being sized relative to the duration and intensity level of said pulsating output.

14. A pump pulsation dampening attachment comprising:

- (a) a pressurized vessel having an interior surface defining a chamber for receiving a liquid, said chamber containing a pocket of air therein for absorbing pulsating fluid flow; and
- (b) a sensing mechanism for monitoring and adjusting the air-to-liquid ratio inside said chamber in response to the duration and intensity of said pulsating fluid flow.

15. The pump pulsation dampening attachment of claim 14, further comprising a supplemental dampener and pulse rate monitor in communication with said chamber for absorbing at least a portion of said pulsating fluid flow and facilitating monitoring of the rate of pulsating fluid flow.

16. The pump pulsation dampening attachment of claim 14, further comprising a sanitary cleaning mechanism for cleaning-in-place the interior surface of said pressurized vessel.

17. The pump pulsation dampening attachment of claim 14, further comprising a pressure regulator in communication with said chamber.

18. A pump pulsation dampening attachment comprising a pressurized vessel having an inlet end for receiving a liquid, an outlet end for dispensing the liquid, an interior surface defining a chamber for containing the liquid, said chamber also containing a pocket of air therein for absorbing pulsating flow of the liquid, and a control end for controlling the air-to-liquid ratio inside said chamber in response to the duration and intensity of said pulsating fluid flow.

19. A pump delivery system adapted for use in a sanitary filling operation, said pump delivery system comprising:

(a) a pump mechanism for delivering a liquid under pressure to a filling machine, said pump mechanism having an inlet port for receiving the liquid and an outlet port in communication with the filling machine for transporting the liquid thereto, said pump mechanism generating a pulsating output during operation; and

(b) a pump pulsation dampening assembly for dampening the pulsating output of said pump mechanism, said pump pulsation dampening assembly disposed in communication with said outlet port and in communication with said filling machine, said pump pulsation dampening assembly including:

(i) a pressurized vessel having an inlet port for receiving the liquid from said outlet of said pump mechanism, an outlet port for permitting a flow of the liquid into the filling machine, and an interior surface defining a chamber for containing and receiving a volume of the liquid from said pump mechanism, said chamber also containing a pocket of pressurized air therein for absorbing said pulsating output generated by said pump mechanism,

(ii) a sensing mechanism for monitoring the air-to-liquid ratio inside the chamber, said sensing mechanism being adaptable for producing an output signal in response thereto,

(iii) an adjustment mechanism in communication with said chamber for providing an adjustment to the air-to-liquid ratio inside said chamber to a desired level in response to said output signal produced by said sensing mechanism,

(iv) a sanitary cleaning mechanism for cleaning-in-place the interior surface of said pressurized vessel, and

(v) a supplemental dampener and pulse rate indicator in communication with said pressurized vessel for absorbing at least a portion of said pulsating output generated by said pump mechanism and also serving as a visual indicator of the pulsation rate of said pump mechanism.

20. The pump delivery system of claim 19, wherein said supplemental dampener and pulse rate indicator is enclosed in an expandable container.

21. The pump delivery system of claim 20, wherein said expandable container comprises a translucent material to permit the rate of pulsation to be observed manually without the aid of tools.

22. The pump delivery system of claim 19, wherein said supplemental dampener and pulse rate indicator comprises at least one

expandable vessel having an interior chamber that expands and contracts in response to the pulsating action of said pump mechanism.

23. The pump delivery system of claim 22, wherein said expandable vessel comprises a deformable material having mechanical memory.

24. The pump delivery system of claim 23, wherein said deformable material comprises rubber.

25. A method of dampening pulsations associated with a pump mechanism which generates a pulsating output during operation, said method comprising the steps of:

(a) utilizing a pressurized vessel having an interior surface defining a chamber for receiving a certain volume of the liquid from the pump mechanism, said chamber containing a pocket of pressurized air therein;

(b) sizing the volumetric capacity of said chamber in response to the duration and intensity level of the pulsating output;

(c) employing a supplemental dampener and pulse rate indicator in communication with said pressurized vessel;

(d) absorbing the pulsating output using said pocket of pressurized air;

(e) supplementing said absorbing step by absorbing at least a portion of said pulsating output using said supplemental dampener and pulse rate indicator; and

(f) observing the pulse rate of said pump mechanism using said supplemental dampener and pulse rate indicator.